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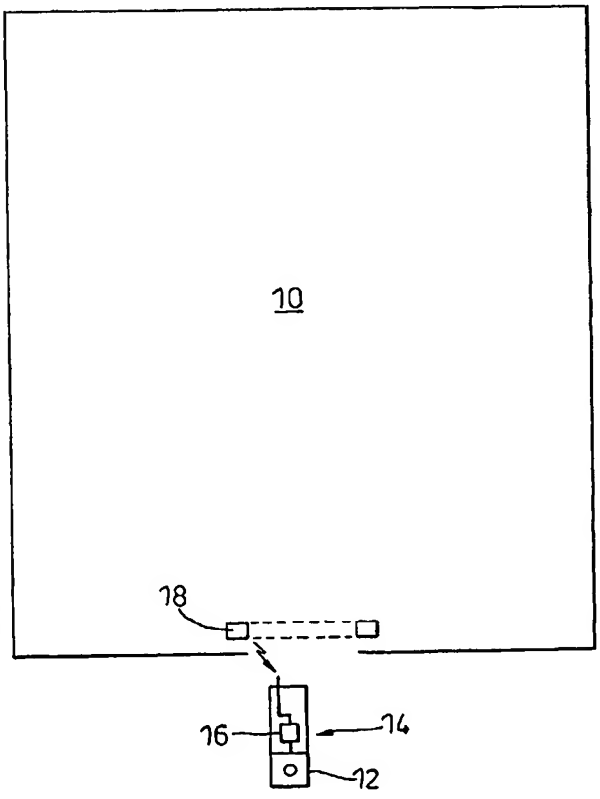
(54) Title: PORTABLE DIGITAL DEVICES



(57) Abstract: A system for controlling usage of a portable digital device (14) having an audio and/or image data recording or capture function (12). Operation of said data recording or capture function is inhibited when the portable digital device is located in a specific geographic location or region (10).

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PORTABLE DIGITAL DEVICES

This invention relates to portable digital devices, to methods for controlling such devices, to systems incorporating such devices and to software for use in such devices. The term "portable digital device" is used broadly to cover many different portable data recording and/or storage devices, such as for example mobile (cell) phones (including camera and video phones), internet-enabled imaging devices (e.g. a digital camera with GPRS (Global Packet Radio Service), PDAs (Personal Digital Assistants), digital cameras, video cameras or MP3 players with or without camera modules. Such devices may use communication methods such as, but not limited to GPRS (Global Packet Radio Service), Bluetooth, WLAN, GSM, CDMA, UMTS, infra-red and SIM update, WAP, 3G or combinations thereof.

The amount of data that may be stored on portable digital devices is rapidly increasing, and likewise data transfer speeds are continually increasing such that there is significant scope for visitors to premises to engage in unauthorised and surreptitious downloading of material from an unsecured PC or terminal. Furthermore, the ongoing development of communications such as 2.5G and 3G (and future generation) technology will provide extremely fast data transfer speeds (typically 144kb/sec to 2Mb/sec) to give transfer speeds similar to current "broadband" technology to mobile users. This opens up many new applications and it is envisaged that integrated devices will be used which combine the functionality of a mobile (cell) phone with that of a camera capable of taking still or moving images. This in turn creates numerous opportunities but also carries with it some risk. For example, making devices widely available

which are capable of capturing and transmitting good still or movie images and/or sound recordings may compromise security in many applications. For example, a legitimate visitor in a commercial premises could surreptitiously record and transmit still or movie images of a sensitive commercial nature, for example images of documents, building layout, industrial processes etc. Elsewhere, in public premises such as museums, theatres, concert halls, etc. a visitor may surreptitiously capture and transmit still or movie images or music performances or the like in contravention of their contractual obligations, copyright law, etc. Concerns have also been expressed at the possibility of images of children or adults being covertly taken in locker rooms etc and there are also religious objections to the unauthorised capture of images of people. These concerns need to be addressed by the service providers and manufacturers if the technology is not to run into problems.

Accordingly, we have determined that there is a need to control usage of portable digital devices such as telephones etc. to prevent their usage in particular locations.

In one aspect, this invention provides a method of controlling usage of a portable digital device having a data recording or capture function, the method comprising inhibiting operation of said data recording or capture function when said portable digital device is located in a specific geographic location or region.

In a first type of system, where the recorded/captured data is audio, image or video data, a security station may broadcast an inhibiting or disabling signal intermittently in the prohibited zone, and at least the audio recording and/or imaging device of the portable digital device will be disabled on receipt of

this signal. The portable digital device is preferably configured so that, once back outside the prohibited zone, the functionality of the audio recording/imaging device is restored. This could be achieved for example by configuring the device such that the imaging functionality is inhibited for a set period after receipt of the disabling signal from the security station, but then returns if no subsequent disabling signals are received. In this system, it is not necessary to determine the location of the portable digital device.

In another embodiment, a portable device (e.g. a specially configured phone) may be used to transmit/broadcast the inhibiting or disabling signal (intermittently) rather than a fixed security station. Thus, the specific restricted geographical location or region can be defined as a certain radius around such a portable inhibiting device. The portable inhibiting device may be carried and activated by a person (thus providing a "personal wireless privacy zone") or it may be carried in/fitted to a vehicle. Another result of using one or more portable inhibiting devices is that they can be used as additional nodes/repeaters to strengthen/broaden the coverage of a signal broadcast by a fixed security station.

In another embodiment, the method includes monitoring the geographic location of the portable digital device, comparing the monitored location with a prohibited zone, and inhibiting operation of said audio recording/imaging device when said portable digital device is in said prohibited zone.

The geographic location may be monitored in numerous ways. In one example the portable digital device may have a navigation module or functionality such as GPS + GSM, GPRS, CDMA, UTMS and 3G). Alternatively,

where the portable digital device operates within a cellular network, the location of the portable digital device may be determined by triangulation of signals from two or more cellular base stations. The system may utilise a local transmitter to increase the overall reception. Where the prohibited zone is in an area accessible only through selected entry points, each entry point may have an induction loop or other detector designed to detect when a portable digital device enters the prohibited zone through said entry point. Other means of detection include infrared signalling and short range low power radio systems such as WLAN, Wi-fi and Bluetooth. Each of the above systems preferably detects not only the presence of the portable digital device but also an information address such as the mobile telephone number uniquely to identify the portable digital device. It will be appreciated that GPS does not normally work in buildings as it requires a line of sight, and so a GPS system may be more appropriate for large out of doors prohibited zones such as airfields etc. For use inside a building the system may be modified, for example, by placing a GPS antenna on the building so that the location of the building is determined and the disabling signal passed to relevant rooms within the building and then broadcast by e.g. an IR or radio transmitter.

Alternatively, instead of actively monitoring for the presence of the portable digital device in a prohibited zone, or entry thereinto, the passage of a portable digital device into the prohibited zone may be deduced indirectly. For example, where employees in a prohibited zone each carry ID cards with unique information carried in a magnetic stripe or "smart" card chip, when the employee swipes his or her card on arriving at work, this may be used to cause the system

to inhibit one or more portable digital devices logged as belonging to the owner of the card.

The method may further include steps of storing data relating to devices detected as being present (or that have been present) in the specific geographical location/region (or the "prohibited zone") and transmitting data to the present devices. For example, the data can include a message indicating that the user has entered an area where photography is not allowed, or where the area is a shop/mall for example, the data could relate to marketing information.

The steps involved in leading to inhibition of the operation of the audio recording/imaging device may be carried out partly at the portable digital device or at a security monitoring station. Thus in some methods the portable digital device may determine its location and transmit this (with or without prior interrogation) to the security monitoring station where the information is compared and, if the portable digital device is in the prohibited zone, the security monitoring station may send back a signal to the portable digital device to inhibit operation of the audio recording/imaging device. Alternatively, the security monitoring device may itself detect the presence of the portable digital device and transmit a signal inhibiting operation of the audio recording/imaging device.

The inhibiting operation may be in terms of a software instruction; for example where the portable digital device transmits the sound file/stream, still or movie image by attaching it to an email, the inhibition may be effected by preventing one of the critical steps in this operation, for example preventing sending of emails, or sending of emails with attachments. Alternatively, the

inhibition operation may comprise disabling the audio recording/imaging device. The inhibiting operation is such as to prevent meaningful information from being transmitted and so in some instances may merely "scramble" the image or sound data. In another embodiment, the inhibition operation may disable the portable digital device itself.

The operation may be inhibited for a predetermined period of time before the operation can be enabled again. The method may include steps of modifying the memory/store of the device in some way (e.g. by saving a cookie file or setting a flag in the memory) to indicate that the inhibition operation has occurred, and checking whether the memory/store has been modified in this way before allowing access the data recording or capture function.

The inhibition operation may be communicated to the portable digital device by a number of ways; for example it may make use of the SMS text messaging system or a software change downloaded by the network operator, i.e. a "SIM update". Alternatively, the signal to the portable digital device to inhibit the operation may be transmitted over one or more radio frequencies, e.g. the signal may be sent using frequencies supported by one or more of GSM, GPRS, 3G, I-Mode, UTMS, Ultrawideband (UWB) wireless data standard and/or CDMA or the like. This can allow the method to work over more than one network. The one or more frequencies may include a "licence-free frequency" and/or a FM/AM radio frequency. The one or more frequencies used to transmit the signal may be changed at intervals to help improve security. Further, the signal may be transmitted in the form of an audio signal/tone, typically one having a frequency outside normal human hearing range. The tone may or may

not be encrypted and can be decrypted at the device if needed. The signal may be transmitted at one or more optical frequencies (fixed or modulated), e.g. infra-red or ultra-violet frequencies. The device may be provided with an optical receiver, which may be integral with or separate from the device.

The method may further include a step of installing code on the device for performing the control of usage of the device. The usage control code may installed by means of being included in a memory, processor or another component (e.g. a SIM card) within the device. The method may further include a step of activating the usage control code, e.g. by transferring it from the SIM card to a processor of the device upon request. The usage control code may be transmitted to the device by "Over the Air" techniques and/or using a Wi-fi "hotspot".

In some cases it may be desirable to at least attempt to permanently inhibit the data recording or transfer operation. Thus, the method can further include a step of modifying or deleting code within the device relating to the operation and/or preventing such code being executed/stored by the device.

The method may include steps of detecting disconnection of the device from the network, and preventing and/or modifying a normal store operation and/or a normal transmission operation relating to captured data upon said disconnection.

The method may include steps of detecting attempted operation of said data recording or capture function (normally when said portable digital device is located in the specific geographic location or region), and preventing a normal store operation and/or a normal transmission operation relating to the captured

data.

A "normal store operation" can include steps usually performed by the device to store the data in memory in a way that allows a user to review and/or manipulate the data using the device. A "normal transmission operation" can include steps usually performed by the device to transmit the data from the device to another entity, e.g. by means of picture messaging, email or a Bluetooth (TM) link.

The method can include a step of deleting the captured data from the device. The method may further include a step of transmitting the captured data to a security entity, e.g. a network operator (such as a mobile phone network or an Internet Service Provider), the police/security agency and/or an authority associated with the geographic region/location, e.g. an employer or personnel department in the case of a workplace. Details of the device/user (e.g. a mobile phone number) that attempted to capture the data may also be transmitted to the security entity. Thus, data intercepted in this way can be thought of as being "confiscated" and the user is reported to a relevant authority.

The method may further include a step of broadcasting a source-identifying signal at the specific geographical location or region. The source-identifying signal may comprise an audio tone, typically one having a frequency that is normally inaudible to humans. Alternatively or additionally, the source-identifying signal may include a series of optical signals or other optical characteristics. Thus, the source-identifying signal and can be thought of as type of audio/visual "watermark" that is captured along with other sound/images at the location/region to identify that the data captured originated at the specific

geographical location/region. The detecting step may include checking if data transmitted over a network includes a recording of the source-identifying signal. Thus, if an attempt is made to transmit the captured data over the network then its transmission can be prevented/intercepted and the data can be transmitted to a security entity instead.

In yet another aspect, this invention provides a method of controlling usage of a portable digital device having a data recording or capture function, the method comprising detecting operation of said data recording or capture function, and preventing and/or modifying a normal store operation and/or a normal transmission operation relating to the captured data. In some cases, the detecting step may only be performed when said portable digital device is located in a specific geographic location or region.

In yet another aspect, this invention provides a method of controlling transmission of data over a communications network, the method comprising steps of: broadcasting source-identifying signal to a specific geographical location or region; detecting attempted transmission of data including the source-identifying signal over the network, and preventing and/or modifying the attempted transmission of data including the source-identifying signal.

In a further aspect, this invention provides a method of storing data relating to devices detected as being present (or that have been present) in a specific geographical location/region and transmitting data to the present devices.

In yet another aspect, the present invention provides a method of disabling a data capture function of a portable digital device connectable to a

communications network, the method including steps of detecting disconnection of the device from the network, and preventing and/or modifying a normal store operation and/or a normal transmission operation relating to captured data upon said disconnection. The disconnection detected may be due to a device/network malfunction (or movement out of range of the network) and/or user-selected disconnection.

The invention also extends to a portable digital device including audio recording and/or imaging devices and means for inhibiting operation of said audio recording and/or imaging devices when said portable digital device is located in a predetermined geographic location or region and/or in response to an externally generated inhibiting signal.

The invention further extends to a communication system including a security monitoring station and one or more portable digital devices as set out above.

Furthermore, the invention extends to a security monitoring base station for use in a system as just described, said security monitoring base station being operable to detect presence of a portable digital device in a prohibited zone and to transmit to said portable digital device a signal inhibiting operation of said imaging device.

Where the data recording/capture device captures data other than image/video data, for example numeric/text data or a software program etc, the system may operate to inhibit operation of the data recording/capture in various ways, analogous to those used for the imaging device as set out above.

At present, some countries ban devices such as camera phones and so

phones may supplied in those countries with the data recording/capture function initially disabled. However, it may be desired to enable the function, e.g. if the phone is taken outside that country. In yet another aspect, this invention provides a method of controlling usage of a portable digital device having a data recording or capture function that is normally disabled, the method comprising enabling operation of said data recording or capture function when said portable digital device is located in (or outside) a predetermined geographic location or region.

Another consequence of increasing functionality of portable digital devices is that they are high value items likely to be stolen. The increasing amount of storage facility on such devices also means that loss or theft of such a device can have dire consequences for the user. Furthermore, as such technology becomes more widely available, the age at which children acquire portable digital devices with imaging functionality is reducing.

We have realised that in the above instances security may be enhanced by providing a facility whereby still or movie images are captured and transmitted back to a central station to assist recovery of lost or stolen portable digital devices, to provide digital evidence of theft for use in a court of law, and also to help authorised users such as parents or guardians to track the whereabouts of their children.

Accordingly, in this aspect, there is provided a method for capturing security information relating to a portable digital device which includes an imaging device, which method comprises enabling operation of said imaging device in response to an interrogation or enabling signal from a central station.

In this aspect the image data received by the central station may be stored for subsequent analysis or it may be rerouted through the cellular network or internet to another duly authorised user.

The signal enabling operation of the imaging device may take many forms; it may be a SMS signal or a SIM update or the various other methods typified herein. In this way the portable digital device may be programmed or controlled to capture and transmit still or movie images back to the central station or to a third party user.

In yet a further aspect, the invention addresses the problem posed by multifunctional portable digital devices which include some form of radio transmitter, e.g. for mobile communications such as GSM or GPRS, or Bluetooth short range radio communication, on board an aircraft. Such devices may interfere with fly by wire systems on board the aircraft and pose a safety threat, but it is impractical for the flight attendants to check that all passengers have switched off such devices.

Accordingly, in this aspect, the invention provides a system comprising a security station located on board a vehicle such as an aircraft, for transmitting a disabling signal to inhibit operation of communications devices incorporated in personal digital devices such as mobile phones or multifunctional devices.

Preferably, the personal digital devices may be configured such that functionality which does not involve radio communication is preserved to allow users to use other functions of the device.

It will be appreciated that some of the methods described herein can be implemented by means of separate and/or remote entities. The scope of the

invention extends to cover such co-operating entities individually as well as jointly.

Whilst the invention has been described above, it extends to any inventive combination of the features set out above or in the following description. In particular it should be noted that the inventive features herein may be implemented in both software and hardware applications.

The invention may be performed in various ways, and embodiments thereof will now be described by way of example only, reference being made to the accompanying drawings, in which:

Figure 1 is a schematic view of a first embodiment of a system designed to inhibit operation of a camera/video on a portable digital device;

Figure 2 is a schematic view of a second embodiment of a system designed to inhibit operation of a camera/video arrangement on a portable digital device;

Figure 3 is a schematic view of a third embodiment of a system designed to inhibit operation of a camera/video arrangement on a portable digital device,

Figure 4 is a schematic view of a portable digital device on which a camera or video may be enabled when the device has been reported lost or stolen;

Figure 5 is a schematic view of a fifth embodiment of this invention;

Figure 6 is a schematic view of a sixth embodiment of this invention, based on a client/server arrangement;

Figure 7 is a flowchart showing steps executed in one embodiment of a client-based process, and

Figure 8 is a flowchart showing steps executed in one embodiment of a server-based process.

Referring initially to Figure 1, there is shown a prohibited zone 10, here in the form of a room, where it is required to prevent operation of a camera or video image capture device 12 on a portable digital device 14. In this embodiment the portable digital device 14 is designed such that, on receipt of a predetermined signal, a circuit 16 inhibits operation of the imaging device 12. This could be by preventing any image capture at all or preventing transmission of an image once captured. In this embodiment the circuit 16 is responsive to an inhibit signal emitted from a low range transmitter 18 located just inside the door into the prohibited zone 10. On leaving the room the camera/video functionality may be restored by transmitting a further signal (not shown) to enable the circuit 16. In this arrangement it is not necessary to determine the position of the portable digital device 14 absolutely because the prohibited zone is accessible through just one access point and so the system only needs to know whether the communication device has been brought in to or out of the zone 10.

Referring now to the second embodiment of Figure 2, a monitoring station 20 is connected to a detector 22 which detects entry of a personal communication device 24 in to the prohibited space 10. On detecting such entry, the monitoring station 20 transmits an inhibit signal to the personal communication device 24 so that the inhibit circuit 26 inhibits operation of the camera 28. In either of these embodiments the inhibit signal could be used to inhibit capture of other, non image data, in addition to or instead of inhibiting capture of the image data.

Referring to the third embodiment of Figure 3, here the portable digital device 30 includes a GPS module which enables it to determine its location using the GPS system. Having determined its location, the portable digital device transmits information identifying its position to a monitoring station 32 which determines whether the portable digital device 30 is within the prohibited zone. If so, then the monitoring station transmits an inhibit signal to the portable digital device 30 to prevent operation of the camera/video 34. It will be appreciated that the system could be modified so that the portable digital device 30 itself determines whether it is within the prohibited zone and, if so, either inhibits operation of the camera/video device 34 or provides a signal to the network/system provider who deactivates the telephone.

Referring now to Figure 4, there is schematically shown a system designed to allow enabling of an on-board camera/video device 40 when a portable digital device 42 has been reported missing. In this instance, the owner of the portable digital device 42 will notify the network provider who will issue a camera enable signal to the portable digital device so that it captures image data and transmits it to the network provider. The image data may be one or more still images or video clips. The network provider can either forward these to the legitimate owner of the portable digital device and/or to the authorities to allow tracking and/or recovery of the portable digital device. Another use of this system would be to allow tracking of unaccompanied minors.

Referring now to Figure 5, this embodiment of device employs "Bluetooth" technology to inhibit operation of a camera module forming part of a mobile (cell) phone. The commercial range of mobile phones is continually evolving but

current typical popular camera phone devices include Nokia 3650 and 7650, Sony Ericcson P800, Samsung SGH-V205, Samsung V200, Sanyo SCP-5300 and Sharp GX10i. There are two main components in this embodiment, namely a camera-phone camera application and a PC application. The camera-phone camera application is a simple picture-taking application that also advertises a new Bluetooth service called "camera restrictor" which is discoverable by a remote device during a Bluetooth discovery routine. The PC application is typically a Windows application (though other types of operating system are not excluded) that uses a Bluetooth stack suite of programs to perform a device enquiry to identify Bluetooth devices in range and to send messages to those devices that advertise the "camera restrictor" service during the Bluetooth discovery routine, to disable the picture-taking application.

The camera application on the phone and the PC application communicate via a serial connection over Bluetooth. The PC application requires no input from the user – it only displays information about the Bluetooth devices that are within range of the PC, and connects automatically to those devices which are advertising the "camera restrictor" service. The camera application allows the user to take photographs (but these are not stored on the device). The user does not control the restricting functionality, but when the camera is restricted (by having received a disabling signal from the PC application) messages are displayed to indicate when the last restricting message was received, and when the restriction is to be lifted (assuming no more messages are received at that time).

The restrictor application shown on the top left of Figure 5 is a Windows

application that uses the Bluetooth stack (typical examples are the stack included in the Windows XP Platform SDK, or the Widcomm stack) to enumerate all Bluetooth devices in range and the services they offer. Once it has finished detecting devices, it connects to each device that advertises a "camera restrictor" service in turn, and sends a simple serial message. The application continuously loops around these actions, detecting devices in range, and then connecting and sending data to those that advertise the "camera restrictor" service. The restrictor application may have the ability to monitor/report upon the number of devices within a restricted area.

The user interface to the restrictor application does not allow for any interaction; it simply displays a list of devices, together with information about each device. In this particular example the following information about each device is stored in an array by the main execution loop:

- Device ID and name
- Device type
- Camera restrictor service advertised
- Time device was last seen
- Time device was last sent serial message (if applicable)

When a device has not been detected for a pre-determined time, it is removed from the array and therefore is no longer shown on the display.

The camera application in the phone handset shown on the top right of Figure 5 allows the user to take pictures using the built-in camera of the mobile phone. It is a simplified camera application that does not store pictures to memory or provide a viewfinder preview. When the camera application starts, it

also advertises a Bluetooth service called "camera restrictor". When a Bluetooth connection occurs using the "camera restrictor" service a serial connection will automatically be established and a flag is set. Whilst this flag is set, the option to take pictures is no longer available to the user. Instead, a message is displayed to indicate that the phone is within a restricted area. A timer is then started and, if it reaches a pre-determined value, the camera functionality is restored. If however a further connection to the "camera restrictor" service is received, the timer is reset, and the camera functionality continues to be suppressed.

In the above embodiment, there may be a finite amount of time between the camera application starting up and enabling the picture taking function, and when the PC application detects the "camera restrictor" service and sends the command that inhibits the picture taking function. In a modification therefore, the camera application may be modified to implement a delay between the camera application starting and full picture-taking functionality.

Alternatively, the "camera restrictor" service could be advertised and handled by the operating system rather than the camera application, to ensure that the camera is disabled well before any camera application is run.

The described embodiment may be used to handle multiple devices within range of the Bluetooth antenna on the PC (typically 10 metres or so).

The mobile phone is preferably arranged to ensure that Bluetooth is permanently enabled and it is preferred for the phone to be configured to automatically accept Bluetooth requests from certain devices. Thus in this embodiment the phone is preferably configured automatically to accept

Bluetooth requests from the PC running the camera restricting software.

It should be appreciated that where the area within which picture taking is to be inhibited is relatively large, several PCs may be set up to provide extended area coverage, each working in a similar manner to that described above.

The restrictor application may use a suitable uplink such as GSM to a central database to confirm the geographic location of the restrictor application and thus the geographic location of the devices that the installation is inhibiting.

Referring now to Figure 6 there is shown an overview of a further embodiment in accordance with this invention.

This embodiment consists of two elements, namely a Client Component and a Server Component.

Client Component

This component runs on a mobile device that is to have some service (such as a camera) inhibited. It is responsible for communicating with the Server component to determine if the phone is located within a region where the service is to be inhibited.

Server Component

This component runs on a central "server" which may be within an office location or general area in which service is to be restricted, or may be executing on some remote server element (perhaps across a wired or wireless LAN or WAN or a GSM, CDMA or other mobile communications network). It will receive information from a Client Component, a mobile network or some other system or device, or some combination of these. From this information it will determine if one or more services or devices within the mobile device containing the Client

Component is to be inhibited. It is responsible for refreshing the inhibition status of the device on a regular basis whilst in the area in which the service is to be restricted.

Figure 7 illustrates steps that can be performed by an embodiment of the functionality-restriction software executed on the portable digital device. The software is ideally the only way to access to the camera functionality of the device so that the functionality-restriction software cannot be bypassed by using another software application on the device. In the example, the device comprises a mobile camera phone having Bluetooth ™ capabilities. The process starts at step 700 and then at step 702 the camera advertises that it is configured with the camera restrictor software using known Bluetooth ™ techniques. For example, the camera restrictor software can be advertised as a Bluetooth (TM) serial port class service with a unique identifier (UID) of 0x1005B8B. Whenever character data is received via this port, the software can switch the device to its restricted mode of operation.

At 704 a question is asked whether a "camera restriction" cookie exists in the memory of the device. This is one example of how the device determines whether the use of camera is restricted, but it will be appreciated by the skilled person that other ways of implementing such a check are possible. In the example, whenever the device is switched to its restricted mode of operation, it creates and stores an empty file (e.g. "C:\restrictor.dat"). This file is used as a "cookie" to indicate that the device is in its restricted mode. If the user exits and restarts the software then the presence of this cookie file indicates that the camera function should start up in the restricted mode. This is intended to

prevent a user from circumventing the camera restriction software by closing the active Bluetooth (TM) service. If the question asked at step 704 is answered in the affirmative then control passes to step 706 where the camera functionality of the phone is disabled and the device is unable to take or show any pictures. The software may display a message on the screen that the device is in a restricted area. After this step, a "camera unlock" timer (e.g. 45 seconds in duration) is started at step 708, with the timer then being decremented at step 710. The number of timer seconds remaining may be displayed on the screen of the device. At step 712 a question is asked as to whether the "camera unlock" timer has expired. If it has not then control is passed on to step 714, otherwise the camera restrictor cookie file is deleted and control is passed to step 716.

At step 714 a question is asked as to whether the camera has entered a restricted zone (i.e. whether the camera has entered an area where photography is prohibited before the current "unlock" timer has expired). If this question is answered in the negative then control is passed back to step 710, otherwise control is passed back to step 706, so that the camera continues to be disabled and the "unlock" timer is restarted.

If the question asked at step 704 is answered in the negative then control is passed on to step 716 and the camera functionality on the phone is enabled. At step 720 the viewfinder of the camera is updated and at step 722 a question is asked whether the camera has entered a restricted zone. If the answer to this question is yes then control is passed on to step 706, otherwise control is passed to step 724.

At step 724 a question is asked as to whether a photograph has been

taken. If the answer is no then control is passed back to step 720, otherwise control is passed on to step 726, where the captured image is displayed on the phone.

Turning to Figure 8, the process performed by the server component commences at step 800 and at step 802 the server searches for Bluetooth ™ devices within the restricted zone. At step 804 a check is carried out as to whether the search is complete. If the check is not complete then at step 806 a question is asked as to whether a new device has been found. If this is answered in the negative then control is passed back to step 804. If a new device was found at step 806 then control is passed to step 808 where the found device is added to the list of known devices stored by the server. Data regarding the device class, the device user identifier and device friendly name may be stored. The server component may display this information to a user at a security monitoring station by means of a standard control list which presents a grid or spreadsheet style of view. In this way, the user can quickly examiner the list of known devices in range and see which devices are configured with the camera restriction software and which of those currently inactive are unable to take any pictures. Steps 802 to 808 can be thought of as a "discovery cycle" of the process and the remaining steps can be thought of as a "restrict cycle ".

If the question asked at step 804 is answered in the affirmative then control is passed on to step 810 where each found device is processed in turn. At step 812 a question is asked whether the device being processed is configured with the camera restriction software. When the server process finds a device that has not been encountered during a previous discovery cycle, it

obtains the list of Bluetooth ™ services that the device offers. In particular, the server process determines if the device is executing the camera restriction software (e.g. based on the Bluetooth UID of 0x10005B8B). To speed up the connection process between devices, it is only necessary to connect a device once and record the session handle. Therefore, the server process sends the restrict command to any devices that have a session handle open and also any devices that have been detected during this cycle.

If the question asked at step 812 is answered in the affirmative then control is passed on to step 814 where the server process sends a restrict signal to the device over the restrictor port. This may take the form of a character string (e.g. "restrict 60000"), which triggers the restriction software on the device to switch to restricted mode (c.f. step 704 of Figure 7). This restriction process can typically place in a period of milliseconds. Control then returns to step 810 so that any further devices can be processed.

If the question asked at step 812 is answered in the negative then control passes to step 816. At this step a question is asked as to whether all the devices in the list have been processed. If not, then control returns to step 810, otherwise control passes back to step 802, i.e. the server process returns to the discovery cycle.

Depending on timing and radio conditions, the time taken to discover and disable a camera phone can vary up to around 30 seconds. This 30 second approximation is derived by assuming that in any 30 second period, the server process in ideal conditions can carry out two discovery mode cycles and up to 8 service discovery requests. Thus, a device can be disabled in less than 15

seconds. Once the server process has discovered an established connection to a device, it is not necessary for the server process to perform further service discoveries on the device. This can improve performance by negating the need for the service discovery cycle on known devices. It should be noted that these timing calculations are exemplary only, as the underlying Bluetooth ™ timings can change depending on a number of radio conditions.

In the above embodiments, a suitably equipped PC may upload software so that it may operate as a base station in a protected area, and the invention extends to a program for controlling a suitably configured computer to operate as a base station. Likewise the software could be loaded onto a wireless gateway, so that the wireless gateway also acted as a base station. Methods of loading appropriate system software onto the mobile device are discussed in the section "Methods for installing software/hardware to the client" below.

Methods for communication with the client device (phone handset, pda etc) to disable the camera or other data capture application

It will be appreciated that ways of transmitting a signal to the portable device to disable the data capture function other than the Bluetooth (TM) embodiment of Figures 7 and 8 can be implemented. These include:

Radio Transmission - (GSM, GPRS, 3G, I-Mode, UMTS, UWB, CDMA etc) Communication between the cell/node antenna and the client could be facilitated by the aforementioned standards that operate in licensed bands that vary in different countries. The concept includes the installation of a 'cell' or node antenna that provides communication with the client within a small or a large areas as determined by the client antenna and radio power. At present, GSM

communicates between client and server/node at a frequencies between 900 Mhz (megahertz) and 1.8 Ghz (gigahertz). 3G communicates between cell antenna and client at around 2Ghz. Other standards may be licensed to communicate at higher or lower frequencies in the future. If the privacy region is to communicate with all phones in the region then the node or 'cell' will need to communicate at all the different frequencies of the different types of clients.

Radio Transmission at Licence-free frequencies – The server/node could communicate with the client using licence-free frequencies. These signals may or may not need encryption to ensure security. This embodiment may include different modulation techniques including spread spectrum technologies. A variant of this is to transmit fm or am radio signals, such as that used in the "itrip" fm transmitter for the "ipod" MP3 player produced by Apple. The application communicates at a particular frequency that can be picked up by a conventional FM radio, to transmit music from the ipod to the radio. Specifically for the system described herein, the server/node could transmit at a similar frequency communicate with the client to disable the camera or other application functionality. Additionally, the server/node can be managed wirelessly or otherwise to change the particular communication frequency at intervals to improve the system security.

Audio communication – The server/node could communicate with the client (handset) by emitting a particular audio signal that can be received by a microphone and/or other audio receiver on the client. This audio communication could be at a frequency that is outside the normal hearing band. This tone may or may not be encrypted.

Optical communication – The server/node could communicate with the client at optical frequencies (fixed frequency or modulated) that is visible or invisible (infra-red or ultra violet) to the human eye. The optical receiver on the client could be separate or it could be the camera.

Methods for installing software/hardware to the client

Over the Air "OTA" techniques – The software component of the system could be transmitted and installed on the client, by the network provider via OTA systems. Over The Air (OTA) is a standard for the transmission and reception of application-related information in a wireless communications system. The standard is supported by Nokia, SmartTrust, and others.

OTA is commonly used in conjunction with the Short Messaging Service (SMS), which allows the transfer of small text files even while using a mobile phone for more conventional purposes. In addition to short messages and small graphics, such files can contain instructions for subscription activation, banking transactions, ringtones, and Wireless Access Protocol (WAP) settings. OTA messages can be encrypted to ensure user privacy and data security.

More recently, OTA systems are becoming more advanced giving network providers the ability to install more sophisticated applications to the clients of their subscribers. Such systems can also offer monitoring/reporting functionality.

SIM Card – The software of the system could be latent within a SIM card and uploaded from the SIM card to the client microprocessor.

Microprocessors – The software of the system could be installed in the microprocessors used in the client. Examples include the Texas Instruments "OMAP" processor, the ARM processor for the central microprocessors or in the Bluetooth (TM) application processors such as those produced by Cambridge Silicon Radio.

Operating Systems – The software component of the system could be available within the operating system of the client. Current examples include Symbian, Microsoft Smartphone OS and manufacturer specific operating systems.

Hotspots (Wi-fi) – The software component of the system could be transmitted to the client through a regional wireless 'hotspot'.

Other embodiments of the system will now be described:

Disabling the camera functionality as standard with the ability to enable.

The embodiments described above mainly concentrate on the disabling of imaging/data recording functionality within a particular area or zone. However, increasingly today the outright banning of camera phones is the standard, e.g. the countrywide ban of camera phones in Saudi Arabia. It follows therefore that the system could disable the imaging functionality as standard with the functionality being enabled on entering a particular area or zone. An example could be that for Saudi Arabia, all camera phones are disabled as standard (affecting all public areas), however on entering a particular area (private dwelling), the functionality is enabled. This embodiment would require a node/server to be installed in the "enabling" area.

Disabling functionality completely

The system can be modified by using the software to attempt to permanently disable the camera functionality. Increasingly today, most clients are being shipped with embedded cameras. Many of these high-end clients are invariably marketed to the large corporate organisations because of their high levels of all round functionality, however increasingly these corporate customers are prohibiting cameras on site. It follows that such high-end phones could still be sold to such corporations with the intention of using the system to permanently disable the camera functionality.

Further functionality

In a further embodiment, the server/node component of the node could be made portable, affording, for example, the ability for an individual to create a "wireless privacy zone" within a certain area of that person's location. The node could be inherent within the client or a separate piece of hardware.

Increasingly, politicians, film stars and other individuals in the public eye are falling victim to the surreptitious taking of their person, image or "brand", by members of the paparazzi or public armed with camera phones. The aforementioned concept would effectively disable localised surreptitious taking of images. In another scenario, members of the public have been caught taking camera/video phone images at the scene of major accidents, including car and rail crashes. Such images, once disseminated onto the Internet, are a major source of concern for friends and families of the victim, not to mention the victim themselves. Following on from this, the ability to use portable nodes within emergency vehicles (ambulance, police, fire), or used by emergency personnel

themselves, would disable surreptitious image-taking at the scene of the incident.

Clients (Handsets) as further nodes/repeaters

Clients with the relevant software/hardware could be used as additional nodes or repeaters to strengthen the disabling signal. In this situation, a public area such as leisure centre may have been installed with a number of nodes to disable imaging functionality for an average number of clients used in that particular location. At certain times of the year, the leisure centre may be frequented by an extraordinary number of people and corresponding handsets which cannot be adequately disabled by the existing node infrastructure. An example could be a large music concert in the main hall of the centre. In this embodiment, each additional client entering the zone acts as a repeater node strengthening the signal therefore the higher the number clients, the stronger the signal and therefore the higher probability of disabling the camera or other features functionality.

Non-compliant handsets used in compliant "wireless privacy zones"

Sometimes, situations may arise whereby a noncompliant handset (i.e. without some or all of the software for implementing the system discussed herein) is used to take surreptitious images in a protected area (i.e. nodes installed and secure zone created). In this situation, a further set of security measures can be included. These measures seek to confiscate the image once it has been taken and an attempt is made to transfer it over a network, e.g. a

GSM network and or ISP's (if sent via Internet). The network may be configured to filter and confiscate the image and alert relevant authorities, e.g. employer, police. The system can use audio and/or visual techniques. In the audio form, the node emits an encrypted tone or "watermark" that is captured within the data recording session but is inaudible to the human ear. Once sent via GSM or the Internet, the relevant filters recognise that the audio file had been recorded surreptitiously in a designated secure zone and "pull it back" or confiscate. At this stage, the network provider or ISP can inform the co-ordinator of the designated secure zone that an individual with a particular phone number took a particular recording in this secure zone and that particular time.

In the visual form, the nodes could emit a series of optical signals or other optical characteristics or the privacy zone could have certain optical characteristics. These characteristics can be filtered by the aforementioned systems and the perpetrator can be brought to justice. These optical characteristics could also be used by including "watermarking" within confidential documents and on confidential plant and machinery, such as the special marks put on cars under development by car manufacturers.

Compliant phone audio/visual watermarking recognition

In a situation whereby a phone does have the relevant disabling functionality, but the GSM, Bluetooth or other communication methods are malfunctioning; the system may need to use a secondary method to stop the image being sent. The system may need to have the ability to confiscate/delete watermarked images and/or audio and possibly alert the network provider.

Node infrastructure used to communicate messages to clients in particular area

The infrastructure represented by the system uses nodes to communicate with compliant clients. This creates a wireless network within a particular area. This network can be utilised further to disseminate particular information to individuals using the client. One example could be in offices whereby pertinent information such as times of upcoming practice fire alarms are sent to the client with corresponding details of the nearest fire exits. Similarly, the network could be used as a direct marketing tool in shopping malls whereby shop locations and special offers can be communicated to the client once it enters the shopping area or zone. Other examples include the streaming of film clips in cinema foyers.

Camera functionality when phone is turned off

Some high end handsets, for example that Handspring Treo can take photo images even when its core communication method (e.g. GSM) is turned off. In this situation, the system can be further enhanced in a number of ways. Firstly, the software ensures that even if the GSM functionality is turned off, other methods of communication are still available to disable the camera's use e.g. Bluetooth (TM), infra-red, Wi-Fi and so forth. Secondly, the system and corresponding software can force the camera functionality to be disabled as standard once radio communication has been switched off. Thirdly, the system could be incorporated into the client software such that it transmission is disabled if it has photo attachments whilst in the privacy zone.

MP3 players and USB portable drives

Increasingly, MP3 players like the "ipod" and other portable drives have the ability to store images and record audio. The aforementioned system could cover these devices also, stopping recording in protected locations.

Audio Recording

Both 2G and 3G handsets have the ability to record considerable amounts of audio data. The examples described above could be adapted by the skilled person to disable a microphone for capturing audio rather than (or in addition to) disabling a camera or the like for preventing of image capture.

CLAIMS

1. A method of controlling usage of a portable digital device (14) having an audio and/or image data recording or capture function (12), the method including inhibiting operation of said data recording or capture function when said portable digital device is located in a specific geographic location or region (10).

2. A method according to Claim 1, wherein one or more fixed location security stations (20) and/or one or more other portable digital devices broadcast/transmit an inhibiting or disabling signal intermittently in the specific geographic location or region (10), and at least the audio and/or image function (12) of the portable digital device (14) being disabled on receipt of the signal.

3. A method according to Claim 1 or 2, wherein the portable digital device (14) is configured so that, once back outside the specific geographic location or region (10), the function (12) is restored.

4. A method according to Claim 2, where the one or more other portable devices (14) are used as repeaters to strengthen/broaden coverage of the signal broadcast/transmitted by the one or more fixed location security stations (20).

5. A method according to any one of the preceding Claims, further including steps of:

monitoring the geographic location of the portable digital device (14);

comparing the monitored location with the specific geographical location or region (10), and

inhibiting operation of said function (12) when said portable digital device is in the specific geographic location or region.

6. A method according to Claim 5, wherein the geographic location of the

device (14) is monitored by means of a navigation module or functionality such as GPS + GSM, GPRS, CDMA, UTMS and 3G.

7. A method according to Claim 5 or 6, wherein the geographic location of the device (14) is monitored by means of triangulation of signals from two or more cellular base stations.

8. A method according to any one of the preceding Claims, further including steps of storing (808) data relating to a said device (14) detected as being present (or that has been present) in the specific geographical location or region (10).

9. A method according to any one of the preceding Claims, wherein the function (12) is inhibited for a predetermined period of time before the function can be enabled again.

10. A method according to any one of the preceding Claims, wherein the method includes steps of:

modifying (812) the memory/store of the device (14) to indicate that the inhibition operation has occurred, and

checking (704) whether the memory/store has been modified to indicate that the inhibition operation has occurred before allowing access the data recording or capture function (12).

11. A method according to any one of the preceding Claims, wherein the inhibition operation is communicated to the portable digital device (14) by means of a signal transmitted over one or more radio frequencies, e.g. the signal may be sent using frequencies supported by one or more of GSM, GPRS, 3G, I-Mode, UTMS, Ultrawideband (UWB) wireless data standard and/or CDMA.

12. A method according to Claim 11, wherein the one or more frequencies used to transmit the signal are changed at intervals to improve security.

13. A method according to any one of the preceding Claims, wherein the inhibition operation is communicated to the portable digital device (14) by means of a signal transmitted in the form of an audio signal/tone (typically one having a frequency outside normal human hearing range) and/or a signal transmitted at one or more optical frequencies (which can be fixed or modulated).

14. A method according to any one of the preceding Claims, further including a step of installing code on the device (14) for performing the control of usage of the device.

15. A method according to Claim 14, wherein the usage control code is installed by means of being included in a memory, processor or another component (e.g. a SIM card) within the device (14) or the usage control code is transmitted to the device by "Over the Air" techniques.

16. A method according to any one of the preceding Claims, further including a step of modifying or deleting code within the device (14) relating to the data recording or capture function (12) and/or preventing such code being executed/stored by the device.

17. A method according to any one of the preceding Claims, further including steps of:

detecting disconnection of the device (14) from a communications network, and

preventing and/or modifying a normal store operation and/or a normal transmission operation relating to captured data upon said disconnection.

18. A method according to any one of the preceding Claims, further including steps of:

detecting attempted operation of said data recording or capture function when said portable digital device is located in the specific geographic location or region, and

preventing a normal store operation and/or a normal transmission operation relating to the captured data.

19. A method according to Claim 17 or 18, further including a step of deleting the captured data from the device.

20. A method according to any one of Claims 17 to 19, further including a step of transmitting the captured data and/or details relating to the device (and/or a user of the device) to a security entity.

21. A method according to any one of the preceding Claims, further including a step of broadcasting a source-identifying signal to the specific geographical location or region.

22. A method according to Claim 21, wherein the source-identifying signal comprises an audio tone (typically one having a frequency that is normally inaudible to humans) and/or the source-identifying signal includes a series of optical signals.

23. A method according to Claim 21 or 22, further including steps of:

checking if data transmitted over a network includes a recording of the source-identifying signal, and

transmitting the data to a security entity instead of its intended recipient.

24. A method according to Claim 1, wherein a security station (20) is fitted on

board a vehicle, said security station broadcasting/transmitting an inhibiting or disabling signal intermittently in the specific geographic location or region (10) on board the vehicle, and at least the audio and/or image function (12) of the portable digital device (14) being disabled on receipt of the signal.

25. A method of controlling usage of a portable digital device (14) having a data recording or capture function (12), the method comprising detecting operation of said data recording or capture function, and preventing and/or modifying a normal store operation and/or a normal transmission operation relating to the captured data.

26. A method of controlling transmission of data over a communications network, the method comprising steps of:

broadcasting source-identifying signal to a specific geographical location or region;

detecting attempted transmission of data including the source-identifying signal over the network, and

preventing and/or modifying the attempted transmission of data including the source-identifying signal.

27. A method of storing data relating to devices detected as being present (or that have been present) in a specific geographical location/region (10) and transmitting marketing data to the devices.

28. A method of disabling a data capture function (12) of a portable digital device (14) connectable to a communications network, the method including steps of:

detecting disconnection of the device from the network, and

preventing and/or modifying a normal store operation and/or a normal transmission operation relating to captured data upon said disconnection.

29. A portable digital device (14) including audio recording and/or imaging devices (12) and means (16) for inhibiting operation of said audio recording and/or imaging devices when said portable digital device is located in a predetermined geographic location or region (10) and/or in response to an externally generated inhibiting signal.

30. A communication system including a security monitoring station (20) and one or more portable digital devices (14) according to Claim 2.

31. A security monitoring base station (20) operable to detect presence of a portable digital device (14) including audio recording and/or imaging devices (12) in a prohibited zone (10) and to transmit to said portable digital device a signal inhibiting operation of said devices.

32. A method of controlling usage of a portable digital device (14) including a data recording or capture function (12) that is normally disabled, the method comprising enabling operation of said data recording or capture function when said portable digital device is located within (or outside) a predetermined geographic location or region (10).

33. A method for capturing security information relating to a portable digital device (14) which includes an imaging device (12), said method comprising enabling operation of said imaging device in response to an interrogation or enabling signal from a central station.

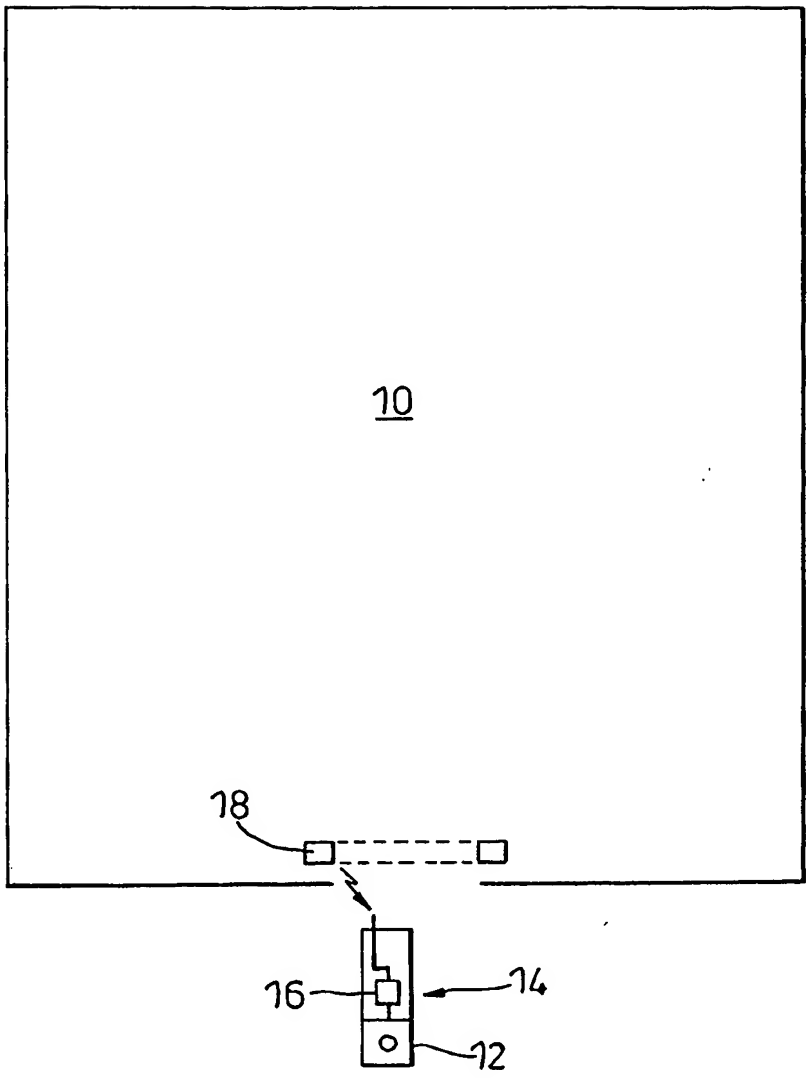

Fig. 1

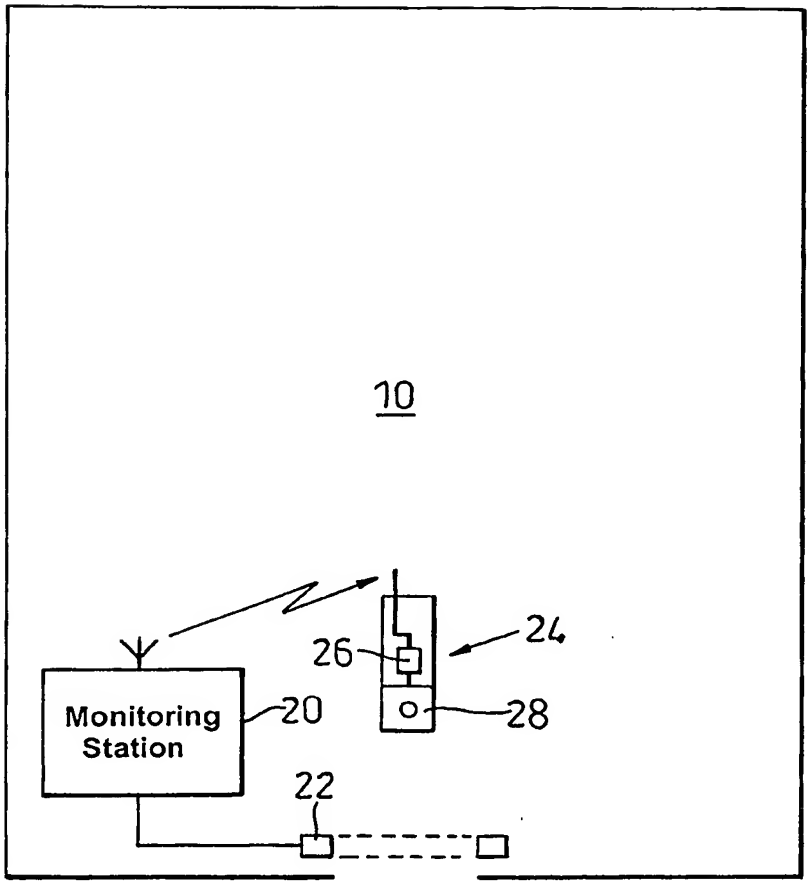

Fig. 2

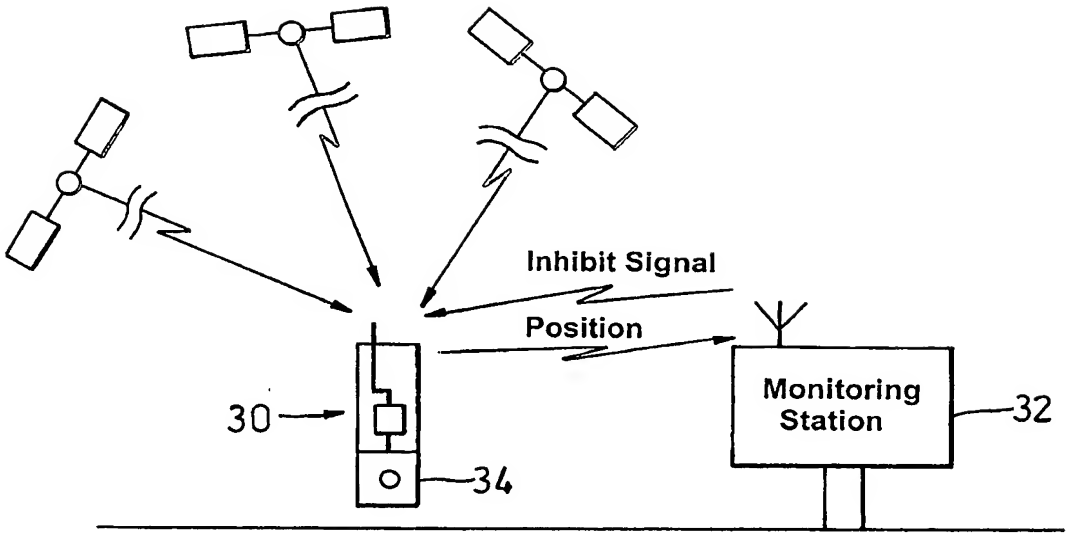
Inhibit Signal
Position
Monitoring Station
32
30
34

Fig. 3

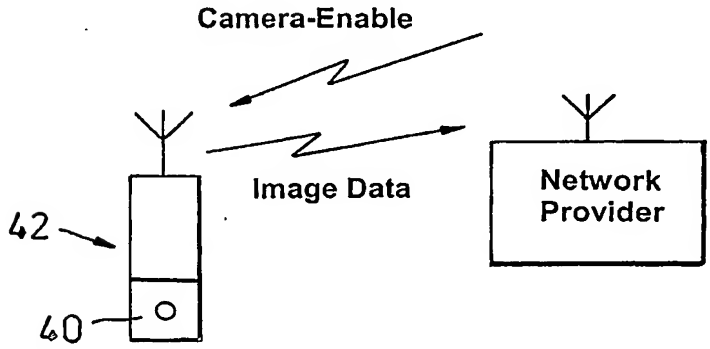
Camera-Enable
Image Data
Network Provider
42
40

Fig. 4

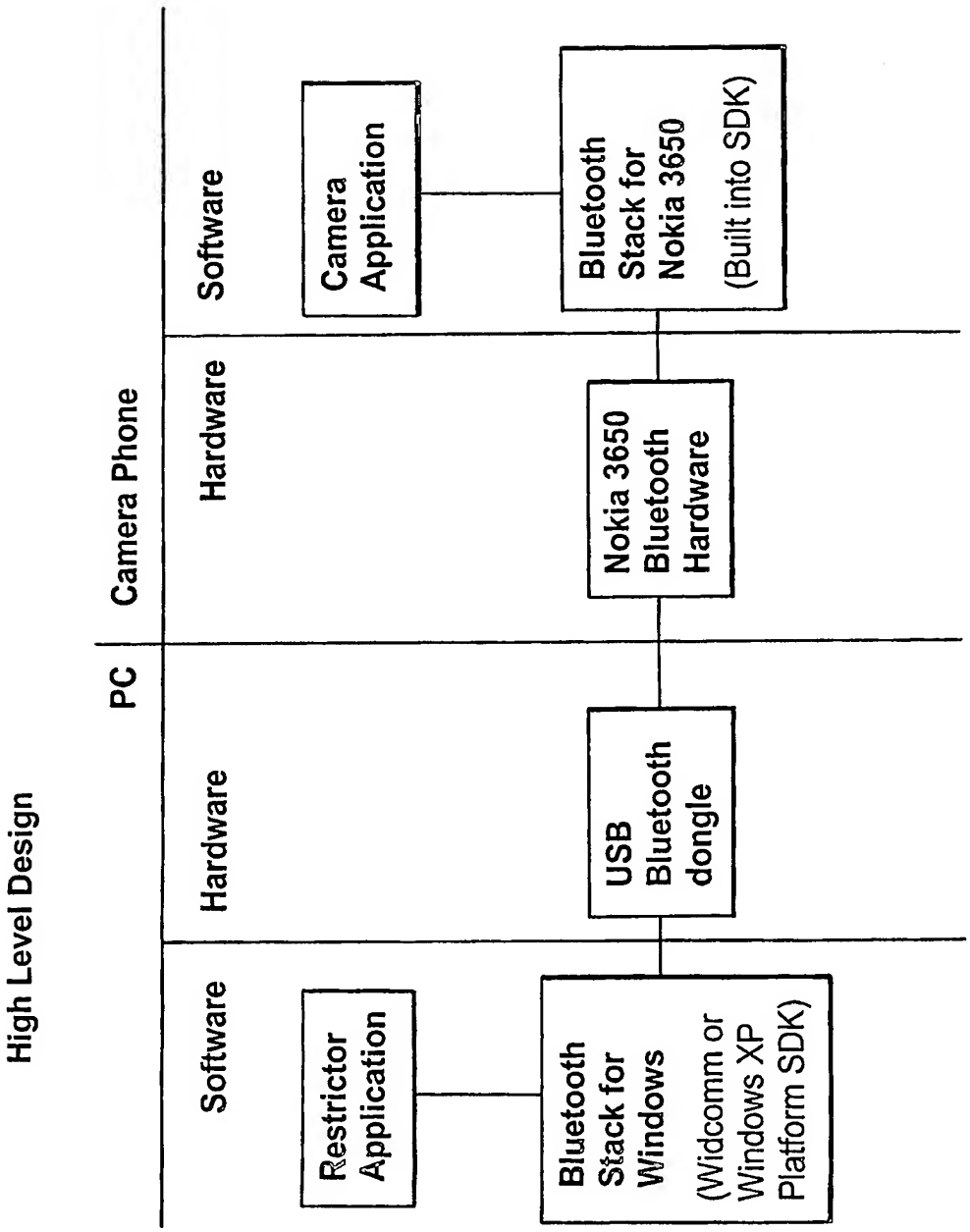
High Level Design
PC
Camera Phone
Software
Hardware
Hardware
Software
Restrictor Application
Bluetooth Stack for Windows (Widcomm or Windows XP Platform SDK)
USB Bluetooth dongle
Nokia 3650 Bluetooth Hardware
Camera Application
Bluetooth Stack for Nokia 3650 (Built into SDK)

Fig. 5

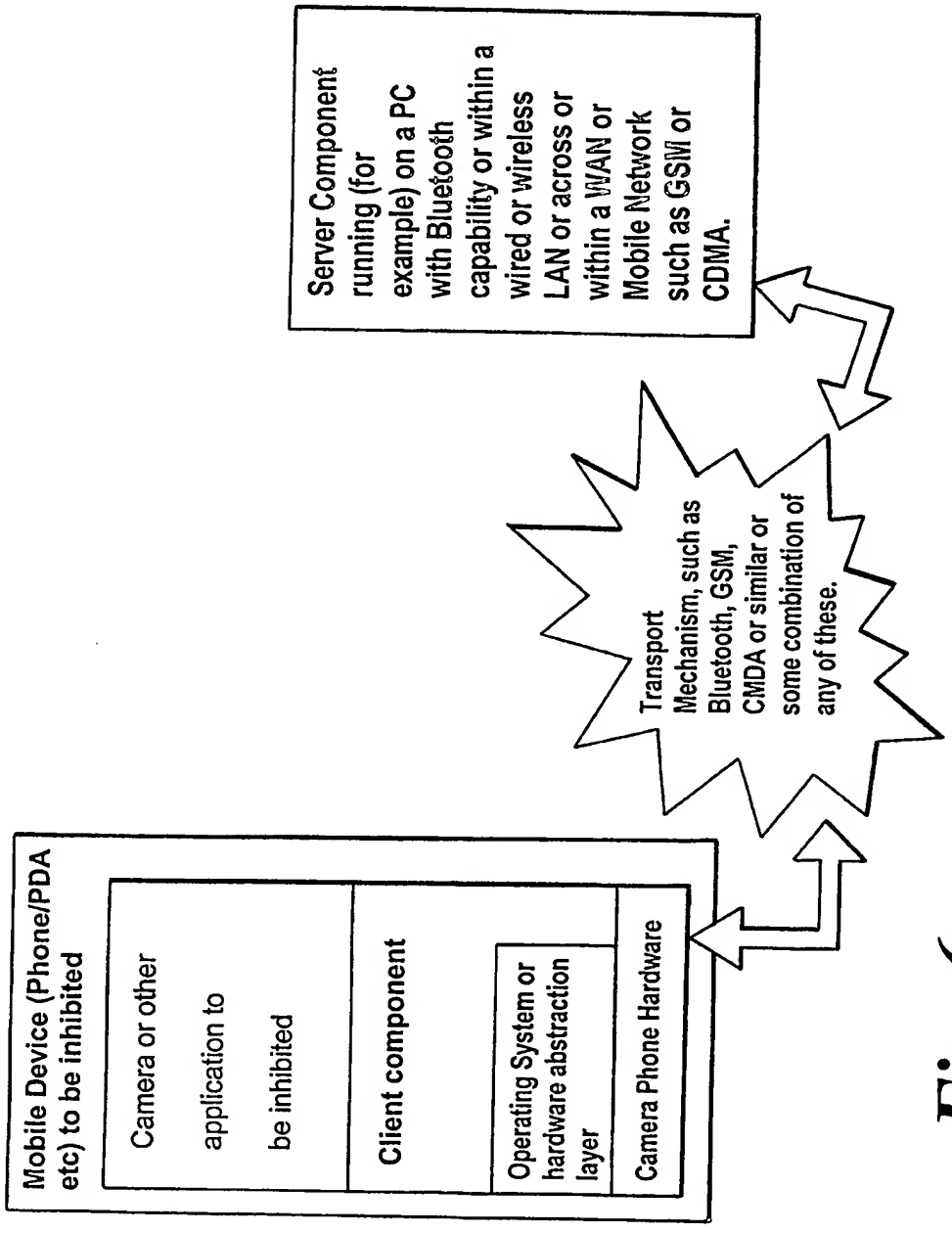
Server Component running (for example) on a PC with Bluetooth capability or within a wired or wireless LAN or across or within a WAN or Mobile Network such as GSM or CDMA.
Transport Mechanism, such as Bluetooth, GSM, CMDA or similar or some combination of any of these.
Mobile Device (Phone/PDA etc) to be inhibited
Camera or other application to be inhibited
Client component
Operating System or hardware abstraction layer
Camera Phone Hardware

Fig. 6

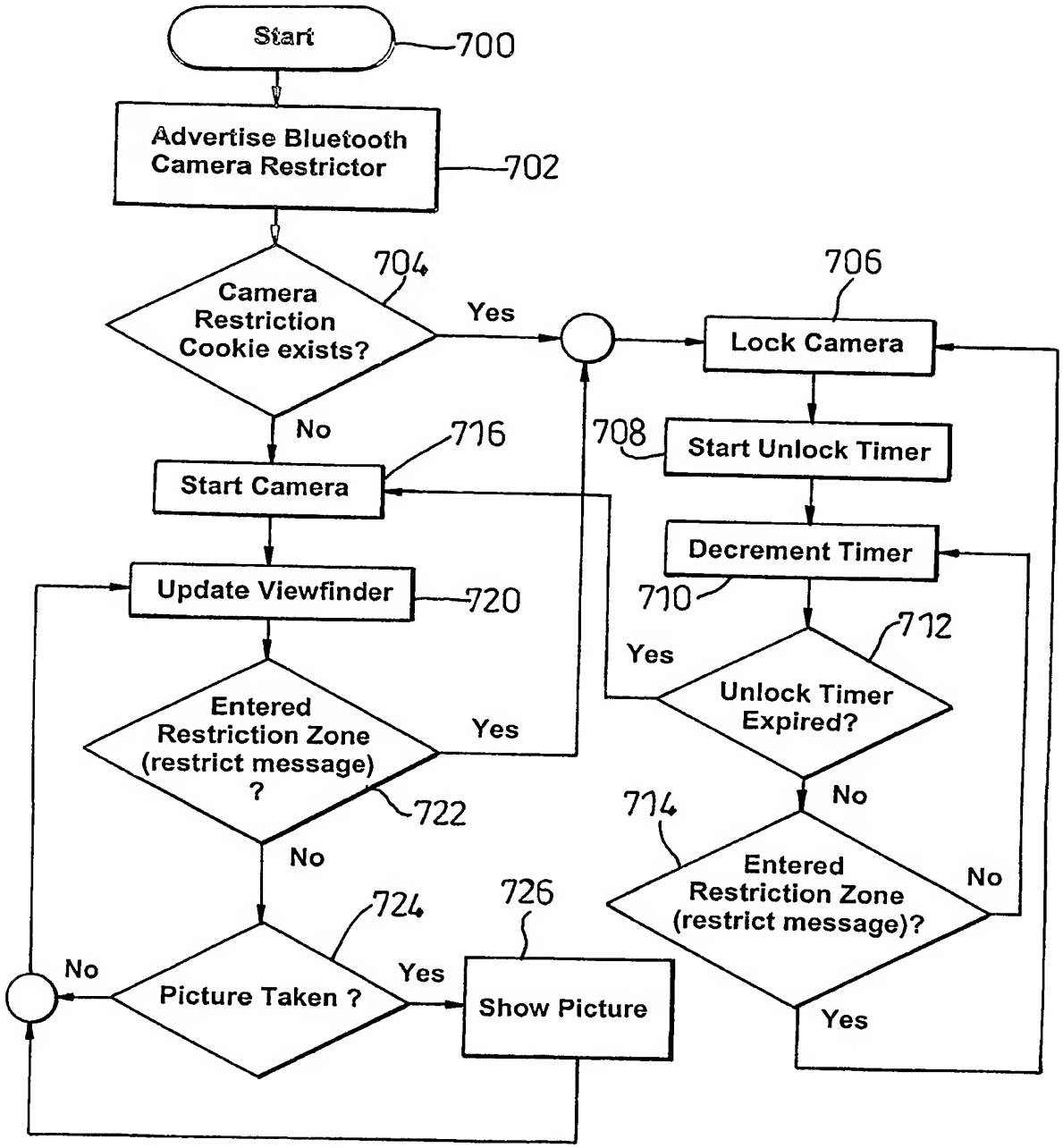
Start
700
Advertise Bluetooth Camera Restrictor
702
Camera Restriction Cookie exists?
704
Yes
No
706
Lock Camera
708
Start Unlock Timer
716
Start Camera
Decrement Timer
710
Update Viewfinder
720
712
Yes
Unlock Timer Expired?
Entered Restriction Zone (restrict message) ?
Yes
722
No
No
714
Entered Restriction Zone (restrict message)?
No
724
726
No
Yes
Picture Taken ?
Show Picture
Yes

Fig. 7

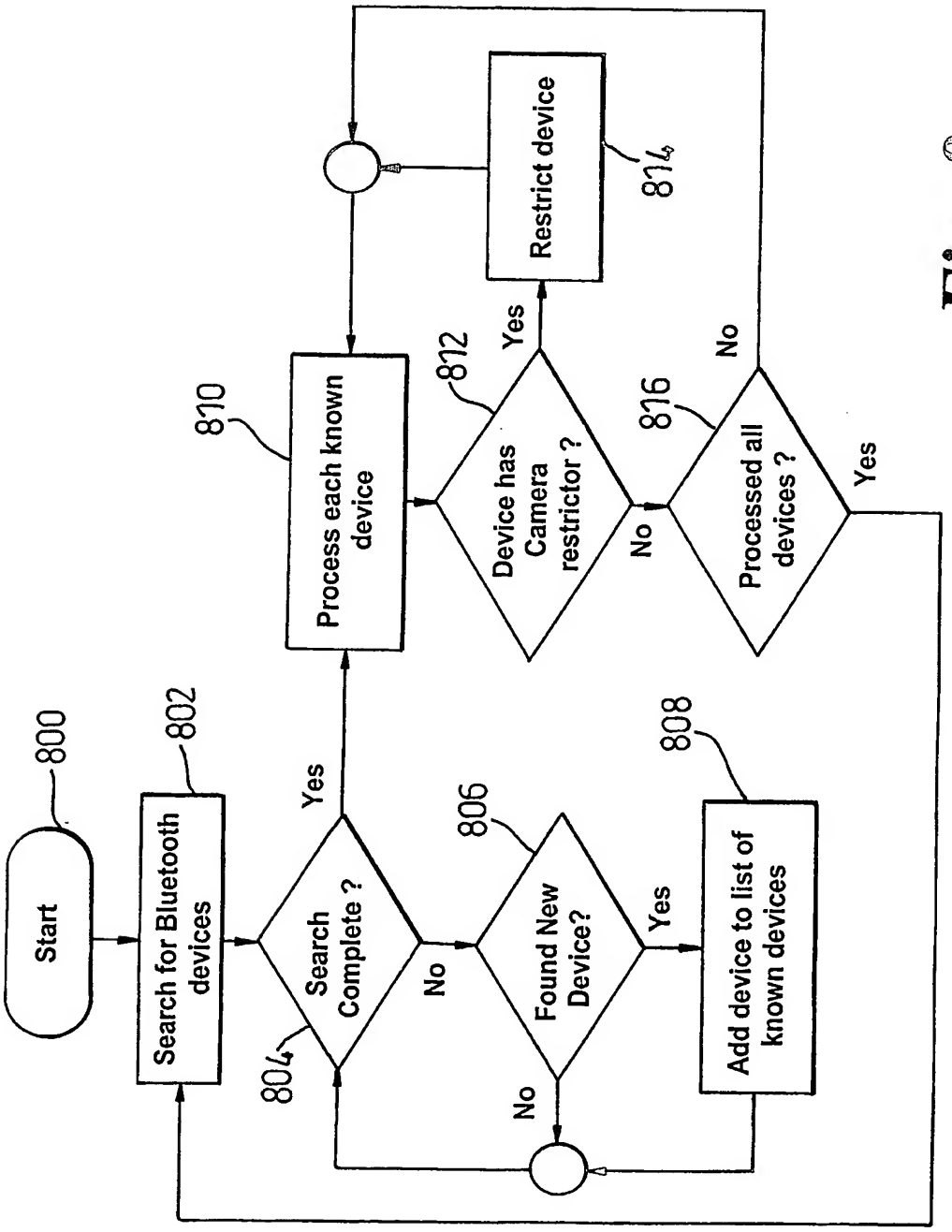
Start
800
Search for Bluetooth devices
802
Search Complete ?
804
Yes
No
Found New Device?
806
Yes
No
Add device to list of known devices
808
Process each known device
810
Device has Camera restrictor ?
812
Yes
No
Restrict device
814
Processed all devices ?
816
No
Yes

Fig. 8